CLAIMS

We claim:

1. A system for using attitude sensors with a camera, said camera being part of a camera assembly, said camera assembly including a fixed portion and a movable portion, said system comprising:

a first sensor coupled to said camera assembly, said first sensor measures movement of said movable portion relative to said fixed portion; and

a first inclinometer coupled to said camera assembly, said first inclinometer measures attitude information of at least a portion of said camera assembly.

2. A system according to claim 1, wherein:

said first sensor measures rotation of said movable portion about a first axis.

3. A system according to claim 2, wherein:

said first inclinometer measures a component of the movement of said first axis.

4. A system according to claim 1, wherein:

said first sensor is an optical encoder.

5. A system according to claim 1, further comprising:

a second inclinometer coupled to said camera assembly, said first inclinometer and said second inclinometer are used to measure an orientation of said camera assembly.

6. A system according to claim 5, wherein:

said first encoder is coupled to said movable portion;

said first inclinometer is coupled to said fixed portion; and

said second inclinometer is coupled to said fixed portion.

7. A system according to claim 5, wherein:

said first sensor measures panning of said camera;

said first inclinometer measures roll of said fixed portion; and

said second inclinometer measures pitch of said fixed portion.

8. A system according to claim 5, wherein:

said first sensor measures tilting of said camera;

said first inclinometer measures roll of said fixed portion; and

said second inclinometer measures pitch of said fixed portion.

9. A system according to claim 5, wherein:

data from said first sensor is combined with data from said first inclinometer and said second inclinometer in order to describe said camera's orientation.

10. A system according to claim 5, wherein:

data from said first sensor is combined with data from said first inclinometer and said second inclinometer, said combined data is used to transform a location in a first coordinate system to a position in a second coordinate system.

11. A system according to claim 5, further comprising:

a second sensor coupled to said camera assembly, said first sensor measures

movement of said movable portion about a first axis and said second sensor measures movement of said movable portion about a second axis, said first inclinometer and said second inclinometer measure movement of said first axis and said second axis.

12. A system according to claim 1, further comprising:

one or more processors, said one or more processors receive data from said first inclinometer and said first sensor, said one or more processors programmed to determine attitude parameters describing an orientation of said camera based on said data from said first inclinometer and said first encoder.

13. A system according to claim 12, wherein:

said one or more processors use said attitude parameters to transform a location in a first coordinate system to a position in a second coordinate system.

14. A system according to claim 1, wherein:

said fixed portion includes a tripod and a tripod head interface;

said movable portion includes at least a portion of a tripod head and said camera;

said first sensor is coupled to said tripod head;

said first inclinometer is coupled to said tripod head interface.

15. A system according to claim 1, further comprising:

sensor electronics located with said camera assembly and in communication with said first sensor and said first inclinometer, said sensor electronics reads data from said first sensor and said first inclinometer and packages said data for

transmission to a processor.

16. A system according to claim 15, wherein:

said sensor electronics encodes said packaged data for transmission in an audio signal to a first location, said processor being located at said first location.

17. A system according to claim 1, further comprising:

a second inclinometer coupled to said camera assembly, said first inclinometer is mounted in a first plane, said second inclinometer is mounted in a second plane, said first plane being orthogonal to said second plane;

a second sensor coupled to said movable portion, said first sensor and said second sensor are optical encoders, said first sensor measures rotation of said movable portion about a first axis, said second sensor measures rotation of said movable portion about a second axis, said first and second inclinometers measure movement of said first axis and said second axis;

a processor programmed to combine data from said first inclinometer, said second inclinometer, said first sensor and said second sensor in order to describe an orientation of said camera, said processor is in communication with said first inclinometer, said second inclinometer, said first sensor and said second sensor.

18. A system according to claim 17, further comprising:

a first gyro in communication with said processor; and

a second gyro in communication with said processor, said processor combines data from said first gyro and said second gyro with data from said first inclinometer, said second inclinometer, said first sensor and said second sensor

19. A method for using attitude sensors with a camera, said camera being part of a camera assembly, said camera assembly including a fixed portion and a movable portion, said system comprising:

sensing data from a first sensor, said first sensor measures movement of said movable portion relative to said fixed portion;

sensing data from a first inclinometer, said first inclinometer measures absolute attitude information of at least a portion of said camera assembly; and

combining said data from said first sensor with said data from said first inclinometer.

20. A method according to claim 19, wherein said step of combining includes:

creating one or more transformation matrices using said data from said first sensor and said data from said first inclinometer.

21. A method according to claim 19, further comprising the step of:

selecting a location in a scene;

converting said location to a position in a video image from said camera, said step of converting is based on said step of combining; and

adding a graphic to said video image from said camera at said position.

22. A method according to claim 19, wherein:

said first sensor measures rotation of said movable portion about a first axis; and

said first inclinometer measures a component of the orientation of said first axis.

23. A method according to claim 19, further comprising the step of:

adding said data from said first sensor and said first inclinometer to an audio signal for transmission to a first location, a first processor is located at said first location, said first processor performs said step of combining.

24. A method according to claim 19, further comprising the step of:

sensing data from a first gyro, said step of combining includes combining said data from said first gyro with said data from said first sensor and said data from said first inclinometer

25. A system for using attitude sensors with a camera, said camera being part of a camera assembly, said camera assembly including a fixed portion and a movable portion, said system comprising:

a first sensor coupled to said camera assembly, said first sensor measures movement of said movable portion with respect to said fixed portion; and

a first gyro coupled to said camera assembly, said first gyro measures attitude information of at least a first portion of said camera assembly.

26. A system according to claim 25, wherein:

said gyro is a fiber optic gyro.

27. A system according to claim 25, wherein:

said first sensor measures rotation of said movable portion about a first axis.

28. A system according to claim 27, wherein:

said first gyro measures movement of said first axis.

29. A system according to claim 25, further comprising:

a second gyro coupled to said camera assembly, said second gyro capable of measuring attitude information of at least said portion of said camera assembly, data from said first gyro, said second gyro and said first sensor is combined to describe an orientation of said camera.

30. A system according to claim 25, further comprising:

a processor, said processor receives and combines data from said first sensor and said first gyro to describe an orientation of said camera.

31. A system according to claim 25, further comprising:

a first inclinometer coupled to said camera assembly; and

a processor, said processor receives and combines data from said first sensor, said first gyro and said first inclinometer to describe an orientation of said camera.

32. A system according to claim 25, further comprising:

a first inclinometer coupled to said camera assembly, said first inclinometer capable of measuring attitude information in a first plane for said camera assembly;

a second inclinometer coupled to said camera assembly, said second inclinometer capable of measuring attitude information in a second plane for said camera assembly, said first plane is different from said second plane;

a second gyro coupled to said camera assembly, said second gyro capable of measuring attitude information in a third plane for at least said portion of said

camera assembly, said first gyro measures attitude information in a fourth plane for at least said portion of said camera assembly, said third plane is different from said fourth plane; and

a second sensor coupled to said camera assembly, said first sensor measures movement of said movable portion with respect to said fixed portion along a first axis, said second sensor measures movement of said movable portion with respect to said fixed portion along a second axis different, said first axis is different from said second axis

33. A system according to claim 32, further comprising:

one or more processors receiving and combining data from said first gyro, said second gyro, said first inclinometer, said second inclinometer, said first sensor and said second sensor;

said one or more processors use said combined data to add a graphic to a video image from said camera at a first position in said video image, said graphic corresponds to a three dimensional location within a field of view of said camera, said three dimensional location corresponds to said first position in said video image.

34. A system according to claim 33, further comprising:

an audio signal generator in communication with and receiving sensor data from said first gyro, said second gyro, said first inclinometer, said second inclinometer, said first sensor and said second sensor, said audio signal generator creates a compatible audio signal which includes said sensor data, said audio signal generator communicates said compatible audio signal to said camera for transmission in said camera audio signal; and

a data extractor receiving said camera audio signal and extracting said sensor data, said data extractor in communication with said one or more processors.

35. A system according to claim 25, further including:
a first circuit for compensating for offset of said first gyro.

36. A system according to claim 25, further including:
a first circuit for reducing error due to drift in said first gyro.

37. A method for using attitude sensors with a camera, said camera being part of a camera assembly, said camera assembly including a fixed portion and a movable portion, said system comprising:
sensing data from a first sensor, said first sensor measures movement of said movable portion relative to said fixed portion;
sensing data from a first gyro, said first gyro measures attitude information of at least a portion of said camera assembly; and
combining said data from said first sensor with said data from said first gyro.

38. A method according to claim 37, further including the step of:
reducing errors due to drift in said first gyro.

39. A method according to claim 37, further comprising the step of:
selecting a location in a scene;
converting said location to a position in a video image from said camera, said step of converting is based on said step of combining; and
adding a graphic to said video image from said camera at said position.

40. A method according to claim 37, further comprising the step of:

sensing data from a second gyro, said step of combining includes combining said data from said second gyro with said data from said first sensor and said data from said first gyro.

41. A method according to claim 37, further comprising the step of:

adding said data from said first sensor with said data from said first inclinometer to an audio signal for transmission to a first location, a first processor is located at said first location, said first processor performs said step of combining.

42. A method according to claim 37, further including the step of:

compensating for offset of said first gyro.

43. A method for using camera attitude sensors with a camera, the method comprising the steps of:

sensing camera attitude information for said camera using a first set of one or more camera attitude sensors; and

transmitting said camera attitude information as an audio signal to one or more processors.

44. A method according to claim 43, wherein:

said camera has a video signal output, an audio signal output and an audio signal input; and

said step of transmitting includes communicating said camera attitude information to said audio signal input.

45. A method according to claim 43, further comprising the step of:

encoding said camera attitude information onto audio or video signal prior to transmitting.

46. A method according to claim 43, further comprising the step of:

removing said camera attitude information from said audio signal.

47. A method according to 46, further comprising the step of:

using said camera attitude information to add a graphic to a video from said camera, said step of using being performed subsequent to said step of determining.

48. A system for using attitude sensors with a camera, said camera having a camera video signal and a camera audio signal in communication with remotely located production equipment, the system comprising:

a first camera attitude sensor; and

an audio signal generator in communication with said first camera attitude sensor, said audio signal generator creates an audio signal which includes data from said first camera attitude sensor, said audio signal generator communicates said audio signal for transmission to said remotely located production equipment.

49. A system according to claim 48, wherein:

said audio signal generator includes a modulation circuit.

50. A system according to claim 48, further comprising:

a data extractor receiving said audio signal and extracting said data from

said first camera attitude sensor, said data extractor is part of said remotely located production equipment.

51. A system according to claim 50, wherein:
said data extractor includes a demodulation circuit.

52. A system according to claim 48, wherein:
said camera includes an audio input and an audio output;
said audio signal generator is in communication with said audio input; and
said audio output is in communication with said remotely located production equipment.

53. A system according to claim 48, wherein:
said first camera attitude sensor is an inclinometer.